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Mule Deer Mortality on Interstate 80 in Wyoming: Causes, Patterns, and Recommendations

Gregory A. Goodwin and A. Lorin Ward[1]

From 1967 through 1975, 571 mule deer (*Odocoileus hemionus*) have been reported killed along a 55-mile section of Interstate 80. Mortality peaks during fall migration, and is highest at Dana Ridge where approximately 900 deer migrate across Interstate 80. The sex ratios of road-killed deer were 27 percent male and 73 percent female, compared to 23 percent male and 77 percent female in the winter population. Deer-vehicle collisions are more frequent in the eastbound lane, except at Dana Ridge where higher downhill traffic speeds result in 69 percent of the kills in the westbound lane. More fawns, predominantly female, are killed in the fall. Eight-foot deer fences can keep resident populations off highways; underpasses can funnel migrating populations under highways.

Keywords: *Odocoileus hemionus,* wildlife mortality, traffic hazards.

Wildlife mortality is increasing as the volume of traffic increases on an expanding highway network (Puglisi et al. 1974). A further understanding of the factors associated with deer highway mortality is needed for future highway planning to reduce deer-vehicle collisions and to provide additional safety for motorists.

Mortality was studied along a 55-mile stretch of Interstate 80 from Quealy Dome, 20 miles west of Laramie, to Walcott. This section of Interstate 80 parallels the Snowy Range Mountains; it presents a barrier to seasonal migration and bisects critical mule deer winter range. This situation provided a unique opportunity to study mule deer mortality associated with a major interstate highway. Our objective was to relate vegetative, physiographic, and population characteristics to the number and location of deer killed.

Interstate 80 is a divided four-lane highway with a right-of-way width varying from 400 to 600 feet. The right-of-way supports a plant community of predominately crested wheatgrass (*Agropyron cristatum*). The right-of-way fences are constructed of woven wire with either two or three strands of barbed wire at the top, with a total height of 46 inches.

[1]*The authors are, respectively, biological technician and research wildlife biologist, Rocky Mountain Forest and Range Experiment Station; research reported here was conducted at the Station's Research Work Unit at Laramie, in cooperation with the University of Wyoming. Station's central headquarters is maintained at Fort Collins, in cooperation with Colorado State University.*

Construction of the highway began in 1967, and was opened to traffic on October 3, 1970. The average daily traffic reported by the Wyoming State Highway Department from 1972 to 1975 was 4,231 vehicles. The heaviest traffic occurred in August (7,584 cars) and the lowest in January (2,012 cars).

The areas surrounding Interstate 80 are sparsely populated and used primarily for livestock grazing. The average elevation is 7,393 feet and the topography is characteristic of foothills including rolling plains, ridges, and pronounced escarpments. The eastern half of the study area is predominately shortgrass prairie; the western half is comprised of extensive stands of big sagebrush (*Artemisia tridentata*). Isolated areas throughout the study area are dominated by true mountainmahogany (*Cercocarpus montanus*), antelope bitterbrush (*Purshia tridentata*), and black greasewood (*Sarcobatus vermiculatus*) which provide important mule deer habitat.

Methods

For the period January 1967 through March 1973, mule deer mortality data consisting of date and approximate locations were obtained from warden reports supplied by the Wyoming Game and Fish Department. Data from April 1973 through January 1976, including sex, exact location, lane (eastbound or westbound), condition, and age were recorded during daily observation trips during migration periods and biweekly trips during the remainder of the year.

Age was determined in the laboratory by examination of incisors for the number of cementum annuli (Low and Cowan 1963) following the procedure described by Crowe (1972).

A 35-mm time-lapse camera (Diem et al. 1973) was used to monitor deer crossings on a 3-mile section of Interstate 80 at Dana Ridge. In the fall of 1974 and 1975, track counts, when snow conditions permitted, were made to estimate the number and locations of crossings at Dana Ridge.

Results and Discussion

Distribution of Deer Mortality

Mule deer center their activities in five areas along Interstate 80: Cooper Cove, Arlington, Wagonhound Creek, Medicine Bow River, and Dana Ridge. The number of deer-vehicle collisions is related to the population size and the physiographic features of each area.

The Cooper Cove area supports an increasing winter population. In 1975, 113 deer were known to have crossed Interstate 80 during the migration. Twenty-two mule deer have been reported killed between April 1973 and December 1975 along this 5.5-mile section of Interstate 80, for a yearly average of 1.3 deer per mile. Forty-five percent of the kills occurred along a 1-mile section of highway that passes through the center of the winter range, where the daily movement of deer results in many crossings. Another 36 percent of the kills occurred along a 1-mile section near Cooper Creek, and were associated with movement along the stream drainage which provides cover and forage.

Resident and migrating populations contribute to vehicle collisions at Arlington. Approximately 100 migrating deer do not cross Interstate 80 during movement to the winter range adjacent to the highway, but they do occasionally cross the highway while occupying this range. The small resident population of 15 to 25 deer creates a potential for highway mortality throughout the year. Forty-eight deer have been reported killed since 1973 along 5.4 miles of Interstate 80, resulting in a yearly average of 2.9 per mile. Most collisions (46 percent) occurred within 0.5 mile of Rock Creek. This drainage supports a dense deciduous forest that borders both sides of Interstate 80. Twenty-five percent of the kills occurred near Threemile Creek, a small stream drainage crossed by Interstate 80.

Wagonhound Creek is a crossing point for up to 200 deer migrating north to a winter range. The number of deer killed, which has increased each year since 1973 due to an increasing population, totals 43 along 4.3 miles of Interstate 80, for an average of 3.3 per mile per year. Deer-vehicle collisions are concentrated near Wagonhound Creek, where topography and vegetation may influence deer movement adjacent to and across Interstate 80.

Resident and migrating deer contribute to mortality in the Medicine Bow River area. Thirty-seven deer have been reported killed along 5.5 miles of Interstate 80, averaging 2.2 per mile per year. There are two areas of high mortality. The first is adjacent to the river, reflecting mortality within the resident population of approximately 40 deer. The remaining mortality occurs within a small migrating population south of the river.

The Dana Ridge area is the crossing point for approximately 900 mule deer during their annual migrations. In the spring, deer migrate from late April through early June, and in the fall, from late November through early January. Few deer spend the winter or summer at Dana Ridge.

No deer were recorded by the 35-mm time-lapse camera from October 1973 through June 1974, indicating the majority of deer cross the highway at night or during poor light conditions at dawn and dusk. The following two winters, track counts in the snow were made to determine major crossing points.

Dana Ridge has the highest mortality of any area along Interstate 80 due to the large number of deer that cross. Seventy deer have been reported killed along 7.9 miles of the highway, for a yearly average of 2.9 deer per mile. Forty percent of all the crossings and 47 percent of all deer-vehicle collisions occurred along a 1-mile section of Interstate 80, resulting in an average of 342 crossings and 19.7 deer killed per mile. This section of Interstate 80 is characterized by 30-foot cuts through a series of rocky, sparsely vegetated ridges that run perpendicular to the highway.

Near the heavy crossing area at Dana Ridge, the right-of-way fence was relocated and run perpendicular to the underpass to guide deer into an existing underpass structure. During the 1974-75 and 1975-76 migrations, 39 tracks were counted in the underpass. This represents only a small portion of the deer that cross Interstate 80, but does suggest that deer will use the underpass.

Deer-vehicle collisions occurred slightly more often in the eastbound lane throughout the year except at Dana Ridge. The eastbound lane is adjacent to the summer range in all areas, and is the first traffic encountered by fawns.

It is difficult to analyze the factors associated with mortality between lanes except for Dana Ridge, where Interstate 80 goes down a steep slope for 3 miles. Of the 70 animals killed here since 1973, 69 percent were killed in the westbound land going down the ridge. To determine if the downhill traffic speeds were higher and thus contributing to the differential mortality between lanes, traffic speeds were sampled on two days during peak migration. Truck speeds averaged 70.3 mph going downhill and 44.4 mph going up. Car speeds averaged 68.7 mph downhill and 65.8 mph uphill. The higher truck speeds down the ridge contribute to the increased mortality in the westbound lane and to the Dana Ridge area. Reducing the speed limit to 55 mph on March 3, 1974 has not measurably reduced the number of deer-vehicle collisions.

Sex and Seasonal Variation

Since the beginning of construction in 1967, 571 mule deer have been reported killed on the 55-mile study section of Interstate 80. Sex, date, and location data were collected for 219 deer killed since April 1973.

Mortality was lowest in late winter and late summer, and highest during the fall migration (fig. 1). Male and female mortalities were similar throughout most of the year except in spring, when male mortality was low and female mortality high (fig. 1). The higher male mortality in the fall is probably associated with the breeding season. The overall sex ratios of road-killed deer—27 percent male and 73 percent female—were similar to the population structure of deer observed on the winter range—23 percent male and 77 percent female. Male mortality was highest (34 percent) at Wagonhound Creek, reflecting the lowered exploitation of bucks in a population that received limited hunting pressure.

Deer are observed in the right-of-way most frequently in spring, feeding on "greening up" crested wheatgrass, the only species planted in the right-of-way. Early growth of crested wheatgrass is characterized by abundant leafiness, a high percentage of crude protein, and a high mineral content (Rauzi 1975). Mule deer diets are comprised of up to 19 percent grass in the spring (Goodwin 1975). These factors contribute to spring mortality by attracting deer into the right-of-way.

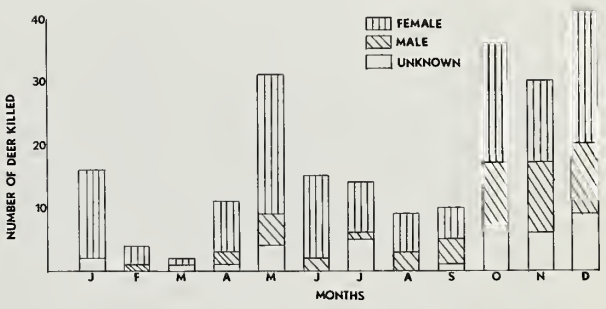

Figure 1.—Male and female deer mortality on Interstate 80 from April 1973 through December 1975.

Age Distribution

The age distribution of mule deer killed on Interstate 80 is characterized in the following tabulation by percentage of animals in the various age classes:

Age class	Males	Females
	percentage in age class	
0 & 1	43	40
2	20	19
3	20	19
4	7	9
5	7	6
6	2	2
7	—	2
8	—	1
9	—	2
10	—	1

Limited data suggest the age structure of the local population is similar.

There is considerable seasonal variation in mortality by age class. During the fall migration (October through January), 30 percent of the deer killed were fawns; during the spring migration (April through June), only 7 percent were fawns. The disproportionate losses between seasons could be attributed to winter losses of fawns. Robinette et al. (1957) reported that the winter loss of fawns is two to three times that of adult deer.

Forty-three fawns have been killed on Interstate 80 since 1973, and only 13 (30 percent) were males. Although the small sample size limits a good evaluation, these data would indicate that male fawns are either less vulnerable to vehicle collisions, or since the greatest fawn mortality occurs in the fall there is greater mortality of male fawns during the summer. Robinette et al. (1957) noted that early postnatal mortality during the first three months may take a higher proportion of male fawns.

Management Implications

Current efforts to reduce deer-vehicle collisions have centered around 8-foot high deer fencing along highway rights-of-way. These fences force deer to use underpass structures to cross highways. Deer fences have been successful in funneling deer into a 10-foot by 10-foot underpass, approximately 100 feet long, under Interstate 70 near Vail, Colorado (Gilbert et al. 1971).

Efforts have also been made to develop a better method of warning motorists of potential deer crossing areas. A lighted, animated deer-crossing sign tested on a State highway in Colorado had little effect on traffic speed or accidents, however (Pojar et al. 1975).

We suggest that deer fences be constructed where large numbers of deer are struck by vehicles. If deer are migrating across the highway, an underpass structure should be located where deer can be funneled into it. In areas where the highway parallels or crosses traditional winter or summer ranges, it may not be necessary to provide a means for deer to cross the highway, but rather, a means to keep them off the highway.

Future highway construction should take into account the characteristics of deer crossing areas. Preconstruction data should be obtained on migration routes, winter and summer ranges that will be crossed, and population densities. Then necessary steps can be taken to prevent accidental deer mortality and auto damage. Cooperation between highway designers and wildlife managers can effectively reduce the number of deer-vehicle collisions.

Literature Cited

Crowe, D. M.
1972. The presence of annuli in bobcat tooth cementum layers. J. Wildl. Manage. 36(4):1330-1332.

Diem, K. L., A. L. Ward, and J. J. Cupal.
1973. Cameras as remote sensors of animal activities. XI Int. Congr. of Game Biol. Proc., Stockholm, Sweden. 9 p.

Gilbert, D. F., D. F. Reed, and T. M. Pojar.
1971. Migratory deer and Interstate 70 in western Colorado. *In* Proc. 51st West. Assoc. of State Game and Fish Comm., p. 436-446.

Goodwin, G. A.
1975. Seasonal food habits of mule deer in southeastern Wyoming. USDA For. Serv. Res. Note RM-287, 4 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

Low, W. A., and I. M. Cowan.
1963. Age determination of deer by annular structure of dental cementum. J. Wildl. Manage. 27(3):466-471.

Pojar, T. M., R. A. Prosence, D. F. Reed, and T. N. Woodward.
1975. Effectiveness of a lighted, animated, deer crossing sign. J. Wildl. Manage. 39(1):87-91.

Puglisi, M. J., J. S. Lindzey, and E. D. Bellis.
1974. Factors associated with highway mortality of white-tailed deer. J. Wildl. Manage. 38(4):799-807.

Rauzi, F.
1975. Seasonal yield and chemical composition of crested wheatgrass in southeastern Wyoming. J. Range Manage. 28(3):219-221.

Robinette, W. L., J. S. Gashwiler, J. B. Low, and D. A. Jones.
1957. Differential mortality by sex and age among mule deer. J. Wildl. Manage. 21(1):1-16.